A cumulus cloud is easy to get, but how many really good photos have you seen of change cirrus, mammato-cumulus, or scarf cloud? These are a few samples of the big game which it pays to go after, and to be able to exhibit a good specimen picture of such a cloud will be found as satisfactory as the showing of a pair of antlers.

PHOTOGRAPHY OF CLOUDS.

By C. J. P. CAVE.

[Excerpt from "The forms of clouds," Quart. Jour. Roy. Meteorological Soc., 1917, 43: 61-82. (From pp. 80-81.)]

The photography of clouds affords a subject of much interest. There is some difficulty in getting the exposure right until the photographer is somewhat experienced. As a general rule very short exposures are necessary. Clayden says that he has found very slow plates the best for the purpose, with no color screen. My own experience is that panchromatic plates and color screens give the most satisfactory results. I use a moderately deep yellow screen for all clouds except cirrus, but for cirrus I think a red screen is the best. When using color screens the exposure must be lengthened more in proportion than if one were taking ordinary subjects such as landscapes.

Stereoscopic photographs of clouds may be taken by having two cameras at some distance apart and taking two photographs simultaneously; the two cameras must be a quarter of a mile or so apart, except for clouds that are very near the observer. There is another way in which such photographs may be taken which I have not seen described before. If a cloud is moving, two photographs may be taken in succession from the same place, the resulting photographs showing a stereoscopic effect. Unless the clouds are moving very slowly it is advisable to take the two photographs as quickly as possible. Those shown (fig. 27 [not reproduced here]) were taken with an interval of abour 20 seconds. The clouds must be taken when they are moving in a direction at right angles to the line from the cloud to the observer. Of course different parts of the cloud may be moving with different velocities, and in this case the stereoscopic effect will not be true. In figure 27 [not reproduced here] it will be seen that there are about six different distances to be seen at the left-hand top corner of the picture. In the case of cloud sheets which are moving fast I have generally found that the stereoscopic effect is exaggerated and the sheet looks as though it were very low down. The chief difficulty in this way of taking stereographic photographs of clouds is that the form of the clouds changes even in the short interval between the two exposures.

CLOUD PHOTOGRAPHY.

[Reprinted from Scientific American Supplement, New York, Mar. 3, 1918, 163.]

A method recommended for cloud photography consists in the use of a device made up of a mirror of black glass mounted in a special frame and placed in front of the camera lens, so that the photograph will be taken from the mirror and the brilliant light of the clouds will be thus diminished. However, it is difficult to procure such black glass mirrors in ordinary trade, but it is comparatively easy to make a suitable mirror. This is done by taking a piece of clear glass such as is used for making mirrors and roughening one side after the manner of ground glass. On this latter side is applied a coating of black varnish made of Judaea bitumen. This avoids the double reflection which would be produced by using ordinary glass and simply putting on a coat of varnish. The time of exposure is, of course, much longer than in the usual way and may be from one-fifth to one twenty-fifth second when well stopped down. It is claimed that this arrangement allows of obtaining details of clouds which can not be had otherwise by the most improved plates and screens.

CUMULUS CLOUD OVER FIRE.

By OTTO NEUMER.

On September 13, about 4.30 p. m. (seventy-fifth meridian time) I was approaching New York City on a train, and, when between Rahway and Elizabeth, N. J., I observed a heavy black cloud in the direction of New York City. The cloud, I discovered later, was a smoke cloud and was hanging over New York Bay. The fire, which caused the great volume of smoke was in the Borough of Queens, just across the East River from Manhattan. The smoke rose almost vertically until it reached a height of about 1,500 meters, then passed off apparently horizontally to the southeast or south under the influence of a moderate or strong wind at that altitude. This wall of dense smoke extended from its origin in Queens as far as one could see toward the south. Directly in line with what seemed to be New York Bay, the smoke cloud was capped by a small puff of white—a small cumulus cloud. The formation seemed to be 400 or 500 meters long and very shallow. I do not think it lasted long, although I was unable to observe it longer than 10 minutes. There were no other clouds visible at the time.

NOTE.—The surface meteorological conditions at the New York Weather Bureau, at 4.30 were as follows: Temperature 21.7° C.; wind NW., 8.9 meters per second; dewpoint (noon) 7.8° C. Substituting these values in the equation for the height of the base of the cloud,[1] we obtain 1,800 meters, which is quite in accord with non-instrumental observations of Mr. Neumer.—*C. L. M.*

METEOROLOGICAL ASPECTS OF A MUNITION-DUMP EXPLOSION AT KIEV, JUNE 6, 1918.

By Dr. FRIEDRICH NOWOTNY.

[Abstracted from *Meteorologische Zeitschrift*, Mar.-Apr., 1920, pp. 67-73.]

At 10 a. m., June 6, 1918, about 11,000 tons of explosives stored at the munition depot of Zwierniec, a suburb of Kiev, were exploded from a fire which started in a bomb factory. The magnitude of the disaster may be surmised from the fact that at least 200 were killed and over 1,000 injured. The town of Zwierniec was almost completely destroyed through the agency of fire and air pressure. Other towns 6 and 8 kilometers distant were badly shaken and much property was destroyed. The meteorological conditions on the day in question were carefully observed both at the Austro-Hungarian meteorological station in that vicinity and by the author.

At the time of the catastrophe the sky was about seven-tenths covered with cumuli, whose bases were at about 1,300 meters elevation. The explosions sent dense masses of black smoke into the air, probably reaching an elevation of 3,600 meters, although the great mass of smoke reached the height of 3,200 meters. The clouds

[1] See "Heights of cumulus clouds forming over fires." MONTHLY WEATHER REVIEW, March, 1919, 147-149.

were moving slowly from the northwest, but the explosion served to tear the clouds apart and create an opening directly above. (* * * "*es bildete sich plötzlich ein Loch in der cu-Decke.*") After a while the slow southeastward motion was resumed. A light rain fell on the opposite side of the Dnieper River from the mass of cloud formed at the top of the smoke column.

A phenomenon, which has been observed on several occasions in the case of explosions in the craters of volcanoes[1] was the visibility of the spherically emanating pressure wave against the dark smoke cloud above.

After noon, the vigorous building up of cumuli over the fire had subsided somewhat, but the fact that there continued all through the afternoon fires and minor detonations had considerable influence upon the local wind and actually formed over that region a small low-pressure area. The possibility of the formation of such a small low-pressure area was investigated by calculating the probable amount of heat liberated by the explosions and the burning buildings in comparison with the amount of insolation received over this area. Assuming that 224,000 kg. of explosive materials were involved, it is found that about 160 x 10^7 kg. calories were liberated. This computation is based on other studies on explosive temperatures and the fact that 7 kg. of trinitrotoluol will liberate about 5,000 kg. calories. Other methods of approaching the computation, yield 298 x 10^7 kg. calories. and 211 x 10^7, respectively. The mean of all determinations gives 228 x 10^7 kg. calories. From the burning houses, it is estimated 42 x 10^7 kg. calories were liberated. From the sun, insolation equivalent to 104 x 10^7 kg. calories was received. This gives a total of 374 x 10^7 kg. calories which is more than would be received with a cloudless sky. The area considered was 3 sq. km.

The wind as observed at the Kiev observatory, the Austro-Hungarian station, and the German station, both at the surface and aloft, seem to bear out the point that a weak LOW was formed in this vicinity. Unfortunately, observations from the opposite side of the Dnieper are lacking. Pilot balloon observations at the German station (a few kilometers west of the explosion) showed before the catastrophe a west wind at the surface, becoming west-northwest up to the base of the clouds. The velocities varied from 5 to 14 meters per second. Six hours after the explosion the winds were as follows:

Height.	Direction.	Speed.
M.		*M. sec.*
Surface	NW.	4
100	WSW.	3
230	NE.	9
350	NNW.	4
460	NNW.	5
Above 700 to 3,000.	NW.	5-8

This, combined with the very slight evidence afforded by the barographs, seems to indicate that there was a slight depression formed about the fire.

As to the distances at which the detonations were heard, the author remarks that explosions of one kind and another were so frequent and common in that vicinity that accurate data, such as concerns the "zone of silence," etc., are lacking.

The bearing of such disturbances upon rainfall and its artificial production are logical questions, and the author inclines to the belief that disturbances of this magnitude may result in the production of light rain.[a] But such explosions are neither economical nor practical, and, in general, a drought would be quite as welcome.—*C. L. M.*

[1] Cf. "The visibility of sound waves," by F. A. Perret, *L'Astronomie*, May, 1919, pp. 193-196. Abstract in MONTHLY WEATHER REVIEW, March, 1920, 48: 162-163.

[a] Cf. Espy, James P., Rain from cumulus clouds over fires. MONTHLY WEATHER REVIEW, March, 1919, 47: 145-147.

TABLES OF SUNSPOT FREQUENCY FOR THE YEARS 1902-1919.[1]

By A. WOLFER.

[Zurich, Switzerland, Aug. 15, 1920.]

SYNOPSIS.

This article presents tables of observed and smoothed sunspot numbers which will serve as a continuation to those previously published, carrying them up to the end of 1919.

A discussion of the epochs of maxima and minima from 1610 to the maximum of 1917 results in a revision of the length of the sunspot period from 11.12 years to 11.2.

The revised edition of the Wolf Tables of Sunspot Frequency for the years 1749 to 1900, which were published in 1902 in *Astronomische Mitteilungen* No. 93, and also in the MONTHLY WEATHER REVIEW for April, 1902, has been followed by two supplementary editions, the first of which appeared in 1913 in the *Bulletin of the Mount Weather Observatory*[2] and the second in 1915 in the *Meteorologische Zeitschrift*.[3] The first included the years 1901-1912; the second, 1902-1914. A request from the editor of the MONTHLY WEATHER REVIEW has resulted in the preparation of a third edition in the same form as that of 1902 and including the period beginning in 1901 and ending with 1919.

Table 1 gives the definitive monthly means of the observed daily sunspot relative numbers which one may find published year by year by the Zurich Observatory in the *Astronomische Mitteilungen*. These means are based, without exception, upon careful daily observations, in which one and the same instrument has been employed at the Zurich Observatory on from 270 to 300 days of the year, so that there is not a single day whose value does not rest upon a real observation. As is known from the *Astronomische Mitteilungen*, these observations are supplemented by foreign observations made with different instruments and by different observers, and these are rendered comparable with our own by means of empirically determined reduction factors. Hence, all of the daily spot relative numbers are combined and published in a completely unified system. The monthly means given in Table 1 are followed in the last column by the yearly means and the maxima and minima denoting the 11-year period are made conspicuous by boldface type and italics, respectively.

[1] Translated by C. Le Roy Meisinger.

[2] Vol. 5, pt. 6, p. 365.

[3] Pp. 193-195.